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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/587,194

07/24/2006

Jean-Louis Stehle

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EXAMINER

JELSMA, JONATHAN G

ART UNIT

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1795

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DELIVERY MODE

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/587,194	Applicant(s) STEHLÉ, JEAN-LOUIS	
	Examiner Jonathan Jelsma	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 July 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) _____ is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 July 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>07/24/2006</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Summary

1. This is the initial office action based on application 10/587,194 filed on 07/24/2006 by Jean-Louis Stehle.
2. Claims 1-18 are currently pending and have been fully considered.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
4. Claims 12-15 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
5. The term "about" in claim 12 is a relative term which renders the claim indefinite. The term "about" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It is unclear which range applicant is claiming with the term "about".
6. The term "selected material" in claims 13-15 is a relative term which renders the claim indefinite. The term "selected material" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the

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invention. It is unclear which materials are being claimed that encompass the term "selected material".

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-7, 9-11, and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by ENLOE (US 2003/0186131 A1).

9. ENLOE teaches a reflective mask assembly comprising a reflective mask 1100, a pellicle spacer 1200, and an electrostatic pellicle system 300 (paragraph 0024). The exposure light for the reflective mask system, is extreme ultraviolet light, which may have a nominal wavelength of 11.0-15.0 nm (paragraph 0025). The exposure light is incident reflective mask at an angle of, for example 83.0-85.0 degrees through the protective pellicle structure, indicating negligible deflection or diffraction of the beam (paragraph 0025, Fig 1b). The reflective mask may include a patterned absorber layer 1120 that is located over a surface of a reflective substrate 1110 (paragraph 0027). Wherein, the reflective substrate may be a multilayer reflective substrate comprising alternating layers of molybdenum and silicon (paragraph 0028). The reflective substrate is located over a surface of a low thermal expansion material 1115 (paragraph 0028). The pellicle spacer separates the reflective mask from the pellicle system by a stand-off

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distance, which may be about 1.0-6.0 mm (paragraph 0030), which is greater than the inventions distance of 5000 nm, and so is therefore taken to being greater than the depth of focus and height of pattern/interfering particle. The pellicle system is designed to keep contamination away from the vicinity of the mask during exposure (paragraph 0013).

10. ENLOE teaches using electrostatic forces to collect contaminants, so that they do not interfere with the exposure radiation (paragraph 0061) this may be considered a cleaning process. Electrostatic forces are used to counteract and overcome other forces, such as gravitational and aerodynamic forces (paragraph 0062). Electrostatic forces are applied with appropriate directions and sufficiently large magnitudes, so that positively charged particles are attracted to a negatively charged surface, and negatively charged particles are attracted to positively charged surface (paragraph 0062), or conversely the particles are repelled by the same charged surfaces. Initially uncharged or neutral particles may also respond to the electrostatic forces if a charge is first induced on the particle by an electric field (paragraph 0062). Additionally the contaminant may include water (paragraph 0059), therefore, ENLOE teaches repelling the water contaminant using electrostatic forces, meaning that it may be hydrophobic. Additionally ENLOE teaches measuring, or inspecting, the pellicle at the wavelength of the exposure radiation, using a tunable diode laser absorption spectroscopy (paragraph 0059). Since it is capable of being inspected at the exposure wavelength, it would necessarily also be capable of being inspected at visible wavelengths.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

13. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over ENLOE (US 2003/0186131 A1) in view of KLEBANOFF (US 6,492,067 B1).

14. Claim 8 is dependent upon claim 1, which is rejected above under 35 U.S.C. 102(b) in view of ENLOE. ENLOE teaches a method of keeping contaminants away from a vicinity of a mask with a pellicle, specifically by using the electrostatic effect (abstract). ENLOE does not explicitly teach that the protective structure, the pellicle, has a conductive structure capable of thermophoresis.

15. KLEBANOFF teaches a protective pellicle system which employs the thermophoretic effect to keep particles off the mask (abstract). KLEBANOFF teaches that incorporating thermophoresis provides added particle protection (column 3 lines 65-67). The mask of KLEBANOFF may consist of a substrate with a multilayer reflective

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film, with a mask patterned area on top (column 4 lines 26-33). The thermophoretic protection may be utilized on the mask area itself (column 7 lines 20-23). The patterned mask area is warmer than its surroundings, thermophoresis may be used as a source of particle protection (column 8 lines 43-46).

16. At the time of the invention one having ordinary skill in the art would have been motivated to include the thermophoresis method of KLEBANOFF to mask pellicle system of ENLOE, because KLEBANOFF teaches that the thermophoresis effect is advantageous to give added particle protection (column 3 lines 65-67) as well as a way to counteract any particle contamination from the electrostatic effect of ENLOE (column 7 lines 10-14).

17. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over ENLOE (US 2003/0186131 A1) in view of LEVINSON (US 6,623,893 B1).

18. Claim 13 is dependent upon claim 1 which is rejected above under 35 U.S.C. 102(b) in view of ENLOE. However, ENLOE does not explicitly teach that the pellicle, protective structure, comprises at least one antireflective layer.

19. LEVINSON teaches the coating of a pellicle membrane with an anti-reflective coating (column 7 lines 18-21). LEVINSON teaches the use of the pellicle with an anti-reflective coating in order to have a high transmissivity (column 2 lines 25-30).

20. At the time of the invention one having ordinary skill in the art would have been motivated use an antireflection coating on the pellicle as taught by LEVINSON for the

pellicle of ENLOE, because LEVINSON teaches that the use of the antireflection layer on the pellicle provides excellent transmissivity (LEVINSON column 2 lines 25-30).

21. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over ENLOE (US 2003/0186131 A1) in view of LEVINSON (US 6,623,893 B1) and ANGELOPOULOS (US 2002/0012876 A1).

22. Claim 18 is dependent upon claim 13 which is rejected above under 35 U.S.C. 103(a) in view of ENLOE and LEVINSON. LEVINSON teaches forming an antireflective layer comprising a variety of materials including calcium fluoride (column 7 lines 18-21). However, LEVINSON does not explicitly teach that the material of the antireflective layer is selected from one of a polymer, carbon, carbon nanotubes, silicon, beryllium, ruthenium, silver or zirconium.

23. ANGELOPOULOS however, teaches antireflective coatings for the EUV range, which may include tunable vapor deposited silicon (paragraph 0001).

24. At the time of the invention one having ordinary skill in the art would have been motivated to use the material for the antireflective layer of silicon as taught by ANGELOPOULOS for the antireflective film of LEVINSON, since LEVINSON teaches that any acceptable material may be used, and ANGELOPOULOS teaches that the silicon is an acceptable material for the EUV range. Therefore, the material of the antireflective layer may be determined by routine experimentation by one having ordinary skill in the art.

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25. Claims 1 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over SCOTT (US 5,935,733).

26. SCOTT teaches a reflective mask comprising, a mask substrate with a reflective surface, which may be thin films of alternating reflective and transmissive materials (column 8 lines 19-22, 45-48). The reflective mask may be used in the 13 nm wavelength regime (column 8 lines 45-46). There is also formed an absorbing layer (column 9 lines 60-65) which forms a mask pattern as seen in figure 6c. A transmissive capping layer may be formed over the surface of the patterned reflective mask (column 10 lines 41-52). The resulting mask with a capping material layer as a protective coating, is similar to a pellicle, because it protects the mask (column 11 lines 7-15).

27. SCOTT does not explicitly teach that the protective layer keeps any interfering particles at a distance from the mask pattern that is greater than or equal to the depth of focus of the device, or the height of the pattern interfering particle, nor that this value is between 50 nm and 5000 nm. However, SCOTT does teach that the thickness of the capping layer should be the maximum thickness possible to enable a substantially defect free film and adequately protect the mask structure while providing for clean and accurate transmission of incident light (column 10 lines 57-62). Therefore, SCOTT teaches that the thickness of the capping layer is a result effective variable, and one having ordinary skill in the art would have been motivated to adjust the thickness of the capping layer in order to achieve sufficient protection for the masking layer, as well as maintaining the transmissive properties.

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28. Claims 14-15, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over SCOTT (US 5,935,733) in view of KURT (US 2004/0130693 A1).

29. Claims 14-15, and 17 are dependent upon claim 1, which is rejected above under 35 U.S.C. 103(a) in view of SCOTT. However, SCOTT does not explicitly teach that the capping structure is composed of foam, a structure with channels, or a structure composed of nanotubes oriented in a normal direction to the front face of the reflective structure.

30. KURT using fullerenes as a capping layer to provide a stable and chemically inert protective coating, that is able to retain its initial structure for long periods of irradiation, for improved optical processing (paragraph 0021). Additionally the capping layer, may comprise the fullerene film, and a ruthenium layer on top of the fullerene layer (paragraph 0024). The fullerenes have a relatively low density and therefore a fairly thick capping layer can be used without increasing the optical absorption, which leads to an increased distance between the outer capping layer and the multi-layer mirror, and an improved diffusion barrier (paragraph 0024). KURT additionally teaches that a wide range of different fullerenes can be used (paragraph 0058), and that more densely packed and tightly bound layers can be formed by polymerizing the fullerenes to form chains or networks of molecules connected by covalent bonds (paragraph 0059). Additionally it is noted that a carbon nanotube is a form of a fullerene.

31. At the time of the invention one having ordinary skill in the art would have been motivated to use the fullerene capping layer of KURT in the EUV reflective mask of SCOTT, since SCOTT teaches that it is desirable to attain the maximum thickness of

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the protective layer while maintaining the optical properties (SCOTT column 10 lines 58-61), and KURT teaches the use of the fullerene capping layer in order to have a fairly thick capping layer without increasing the optical absorption (KURT paragraph 0024).

32. Additionally while KURT does not explicitly teach the fullerene capping layer to be of a foam, channeled, or oriented in a structure normal to the reflective structure, it does teach that the fullerene layer is low density (paragraph 0024). KURT also teaches that a wide range of different fullerenes can be used, as well as multi-shelled nested fullerenes (paragraph 0058) as well as more densely packed and tightly bound fullerenes layers (paragraph 0059). Therefore, one having ordinary skill in the art would have been motivated to form the capping layer of KURT in the form of a foam like layer, or which channels, or more densely packed, based on routine experimentation of choosing the desired structure and orientation of the fullerene material.

Conclusion

33. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan Jelsma whose telephone number is (571)270-5127. The examiner can normally be reached on Monday to Thursday 7:00 a.m. - 5:00 p.m.

34. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on (571)272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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35. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mark F. Huff/

Supervisory Patent Examiner, Art Unit 1795

JGJ